


Remarks

Applicants have requested clarifying amendments to the specification and claims in this application. The requested amendments are believed to be proper and unobjectionable.

Respectfully submitted,

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A handwritten signature in black ink, reading "Thomas A. Meehan". The signature is written in a cursive, flowing style.

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5 The shuttle blow molding apparatus of the present invention also includes apparatus for moving each mold set, in sequence, to an elevated position in which it grasps a length of extruded tube and then outwardly in a first transverse direction and downwardly to permit the other mold set to engage another [oppositely directed] length of extruded tube. The other mold set, with the length(s) of extruded tube therein, is then also moved outwardly, in a second, oppositely directed direction, and also downwardly. The length(s) of extruded tube in each mold set is blown during movement of the mold set through a closed path back to its tube grasping position, which is the same for each mold set, for the start of another production cycle.

10 In moving back to their common tube grasping positions, the mold sets first move along spaced apart parallel horizontal paths to positions horizontally spaced from their tube grasping positions, and the lengths of extruded tubes in the mold sets are blown into containers or other hollow articles during this movement.

15 At the conclusion of these horizontal movements, which occur at different times for each mold set, each mold set is then moved upwardly and inwardly to position it for return movement to its extruded tube grasping position. At the conclusion of this upward and inward movement, which sequentially positions each mold set at a common position, the mold set is opened and the container(s) therein removed,

20 before return of the mold set to its tube grasping position. Thus, a single article take-out device can be used to withdraw blown containers from both mold sets because each mold set, in sequence, is at the same position for container removal.

respect to one another to define, when closed, mold cavities in which successive lengths of the tubes T1, T2 are blown into the desired articles. While the simultaneous molding of articles from tubes T1, T2 is described, it is to be understood that it is contemplated that the apparatus 10 can be used to produce only one article at a time from a single extruded tube, or multiple articles from each tube, and to produce one or more articles at a time from each of three or more extruded tubes.

The mold set 14 is mounted on a pair of spaced apart, inclined slides 18 for movement outwardly and downwardly from a position beneath the extruder head 12a, and the slides 18 are mounted on a shuttle 20. The shuttle 20 is mounted for movement in a horizontal plane on a pair of spaced apart slides 22 from a position aligned in a vertical plane with ^{an} [a] extruder head 12a to a position horizontally removed therefrom.

The mold set 16 is mounted on a pair of spaced apart, inclined slides 24 for movement outwardly and downwardly from a position beneath the extruder head 12a, which it occupies after the departure of the mold set 14 from such position, and the slides 24 are mounted on a shuttle 26. In that regard, the outward movement of the mold set 16 from beneath the extruder head 12a is opposed in direction to the outward movement of the mold set 14 from a position beneath the extruder head 12a. In any case, the shuttle 26 is mounted for movement in a horizontal plane on a pair of spaced apart slides 28 from a position aligned in a

vertical plane with the extruder head 12a to a position horizontally removed therefrom.

After each of the mold sets 14, 16 receives and closes around lengths of extruded tubes T1, T2, a blow head, shown in Fig. 3 as the blow head 30 for the mold set 14, aligns itself with the lengths of the tubes T1, T2 therein. The blow head 30 travels with the mold set 14 as the mold set 14 moves rearwardly with the shuttle 20, and injects blowing air or other fluid into the lengths of the tubes T1, T2 in the closed mold set 14 to blow such lengths into finished articles.

When or shortly ^{after} ~~before~~ the mold sets 14, 16 reach their rearmost positions on the slides 22, 28, respectively, the blow head associated therewith is removed therefrom and such mold sets 14, 16 are then sequentially moved upwardly and inwardly on the slides 18, 24, respectively, to a take-out position, shown as the position P in Fig. 1. ^A Then the mold sets 14, 16 are opened and ³² a take-out device [^]

engages the blown containers or other articles in the mold sets 14, 16 ^{and then the mold sets 14, 16 are opened and} to remove completed articles therefrom. [^] As is clear from Fig. 1, the position P is the same for

each of the mold sets 14, 16, which allows for the use of a single take-out device 32 for both of the mold sets 14, 16. Further, the position P is away from a position

beneath the extruder head 12a, for a reason which will be subsequently described in more detail. In any case, the shuttle 20 or the shuttle 26, on which the mold set 14 or

the mold set 16 is mounted, is then moved toward a position beneath the extruder head 12a to begin a repeat of the cycle in connection with subsequent finite lengths

of the extruded tubes T1, T2.

the
articles
are
removed
therefrom.

When it is desired to prelabel containers being produced by the blow molding apparatus 10, ^{and} in-mold labelling device 34 is provided to introduce a label, or an opposed pair of labels, into the mold sets 14, 16 while the mold halves 14a, 14b or 16a, 16b are in a position beneath the extruder head 12a, but while such mold sets are still open. In that regard, an in-mold labelling device in connection with a shuttle blow molding machine is described, for example, in U.S. Patent 4,769,205 (Oles et al.). In any case, it is important that the position at which labels are introduced into the mold sets 14, 16, which is sequentially the same for each of the mold sets 14, 16, be different than the position P at which articles are removed from the mold sets 14, 16, to minimize problems in trying to position multiple devices at the same position on the blow molding apparatus 10.

If it is desired to positively sever lengths of the extruded tubes T1, T2 from successive positions of such tubes, a retractable cut-off knife 36 (Fig. 4) is provided to sever the tubes T1, T2 after lengths thereof have been positively grasped by the mold set 14 or mold set 16, as the case may be. In any case, the downward movement of the mold sets 14, 16 during the outward movement of its mold sets aids in severing the grasped lengths of the tubes T1, T2 from the portions above such grasped lengths.

Fig. 5 illustrates a device, generally identified by reference numeral 40, for capturing the extruded tubes T1, T2 before they are grasped by the mold sets 14, 16, and for securely engaging the extruded tubes T1, T2 while the mold sets 14, 16 are closing around them. This may be useful, for example, to stretch the extruded

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1 1. Apparatus for blow molding containers from a thermoplastic
2 material, said apparatus comprising:

3 an extruder for continuously extruding at least one tube of the
4 thermoplastic material downwardly along a vertical axis;

5 a first mold, said first mold having a first set of mold halves
6 that open and close relative to each other to define, when closed, a first mold cavity;

7 a second mold, said second mold having a second set of mold
8 halves that open and close relative to each other to define, when closed, a second
9 mold cavity;

10 means for moving said first mold along a first closed path to
11 present said first mold at a first position to engage, when open, a first finite length of
12 the thermoplastic tube for blowing of the first finite length of the thermoplastic tube
13 into a container as the first mold moves from the first position to a second position
14 of the first closed path; and

15 means for moving said second mold along a second closed
16 path to present said second mold at the first position to engage, while open, a second
17 finite length of the thermoplastic tube for blowing the second finite length of the
18 thermoplastic tube into a container as the second mold moves along the second
19 closed path to ^a ~~the~~ ^{of the second closed path} second position;

20 the first position of the first closed path and the first position
21 of the second closed path being the same, and the second position of the first closed

22 path and the second position of the second closed path being the same, said
23 apparatus comprising no more than two molds.

1 2. Apparatus for blow molding containers from a thermoplastic
2 material, said apparatus comprising:

3 an extruder for continuously extruding at least one tube of the
4 thermoplastic material downwardly along a vertical axis;

5 a first mold, said first mold having a first set of mold halves
6 that open and close relative to each other to define, when closed, a first mold cavity;

7 a second mold, said second mold having a second set of mold
8 halves that open and close relative to each other to define, when closed, a second
9 mold cavity;

10 means for moving said first mold along a first closed path to
11 present said first mold at a first position to engage, when open, a first finite length of
12 the thermoplastic tube for blowing of the first finite length of the thermoplastic tube
13 into a container as the first mold moves from the first position to a second position
14 of the first closed path;

15 means for moving said second mold along a second closed
16 path to present said second mold at the first position to engage, while open, a second
17 finite length of the thermoplastic tube for blowing the second finite length of the
18 thermoplastic tube into a container as the second mold moves along the second
19 closed path to ^athe second position; ^{of the second closed path}

the first position of the first closed path and the first position of the second closed path being the same, and the second position of the first closed path and the second position of the second closed path being the same; and

a single in-mold labelling device positioned being beneath the extruder to introduce labels into the first and second molds as the first and second molds proceed along the first closed path and the second closed path, respectively.

3. Apparatus according to Claim 1 and further comprising:

a single container take-out device for successively removing blown containers from the first mold and the second mold at the second position.

4. Apparatus according to Claim 3 wherein:

the second position is horizontally spaced from the first position.

5. Apparatus according to Claim 4 wherein:

the second position and the first position are at the same elevation.

6. Apparatus according to Claim 1 wherein:

the first closed path includes a first leg extending outwardly in a first direction and downwardly from the first position; and

the second closed path includes a first leg extending outwardly in a direction opposed to the direction of the first leg of the first closed path and downwardly.

7. Apparatus according to Claim 2 and further comprising:

2 a single container take-out device for successively removing
3 blown containers from the first mold and the second mold at the second position.

1 8. Apparatus according to Claim 7 wherein:
2 the second position is horizontally spaced from the first
3 position.

1 9. Apparatus according to Claim 8 wherein:
2 the second position and the first position are at the same
3 elevation.

1 10. Apparatus according to Claim 2 wherein:
2 the first closed path includes a first leg extending outwardly in
3 a first direction and downwardly from the first position; and
4 the second closed path includes a first leg extending
5 outwardly in a direction opposed to the direction of the first leg of the first closed
6 path and downwardly.

1 11. A method of blow molding containers from a
2 thermoplastic material, the method comprising:

3 substantially continuously extruding a thermoplastic material
4 downwardly ^{along} a vertical axis;

5 engaging a first finite length of the thermoplastic material in a
6 first mold set at a first position of the first mold set;

7 moving the first mold set in a closed path having a first leg in
8 which the first mold set is moved from the first position (^{outwardly}upwardly) in a first direction
9 and downwardly;

10 engaging a second finite length of the extruded thermoplastic
11 material in a second mold at the position where the first finite length of the extruded
12 thermoplastic material was engaged by the first mold set after the first mold set has
13 moved along the first leg of its first closed path;

14 moving the second mold set along a second closed path
15 having a first leg extending outwardly in a second direction from the first position
16 and downwardly, the second direction being opposed to the first direction;

17 removing the blown containers from the first mold set at a
18 second position of the (^{first}second) closed path, the second position being spaced
19 horizontally away from the first position; and

20 thereafter removing the blown containers from the second
21 mold set at a second position of the second mold set, the second position of the
22 second mold set being the same as the second position of the first mold set;

23 the method comprising using no more than two molds.

1 12. A method of blow molding containers from a
2 thermoplastic material, the method comprising:

3 substantially continuously extruding a thermoplastic material
4 downwardly ^{along} a vertical axis;

5 engaging a first finite length of the thermoplastic material in a
6 first mold set at a first position of the first mold set;

7 moving the first mold set in a closed path having a first leg in
8 which the first mold set is moved from the first position ^{outwardly} ~~upwardly~~ in a first direction
9 and downwardly;

10 engaging a second finite length of the extruded thermoplastic
11 material in a second mold at the position where the first finite length of the extruded
12 thermoplastic material was engaged by the first mold set after the first mold set has
13 moved along the first leg of its first closed path;

14 moving the second mold set along a second closed path
15 having a first leg extending outwardly in a second direction from the first position
16 and downwardly, the second direction being opposed to the first direction;

17 removing the blown containers from the first mold set at a
18 second position of the ^{first} ~~second~~ closed path, the second position being spaced
19 horizontally away from the first position;

20 thereafter removing the blown containers from the second
21 mold set at a second position of the second mold set, the second position of the
22 second mold set being the same as the second position of the first mold set; and

23 applying labels, in sequence, to interiors of the first mold set
24 and the second mold set, the labels being applied to the interiors of the first mold set
25 at the first position of the first mold set and being applied to the interiors of the
26 second mold set at the first position of the second mold set.

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1 13. Apparatus for blow molding containers from a thermoplastic
2 material, said apparatus comprising:

3 an extruder for continuously extruding at least one tube of the
4 thermoplastic material downwardly along a vertical axis;

5 a first mold, said first mold having a first set of mold halves
6 that open and close relative to each other to define, when closed, a first mold cavity;

7 a second mold, said second mold having a second set of mold
8 halves that open and close relative to each other to define, when closed, a second
9 mold cavity;

10 means for moving said first mold along a first closed path to
11 present said first mold at a first position to engage, when open, a first finite length of
12 the thermoplastic tube for blowing of the first finite length of the thermoplastic tube
13 into a container as the first mold moves from the first position to a second position
14 of the first closed path;

15 means for moving said second mold along a second closed
16 path to present said second mold at the first position to engage, while open, a second
17 finite length of the thermoplastic tube for blowing the second finite length of the
18 thermoplastic tube into a container as the second mold moves along the second
19 closed path to ^athe second position; ^{of the second closed path}

20 the first position of the first closed path and the first position
21 of the second closed path being the same, and the second position of the first closed
22 path and the second position of the second closed path being the same; and

means separate from the first mold set and the second mold set for grasping the extruded tube and for moving downwardly before a finite length of the extruded thermoplastic tube is grasped by the first mold set or the second mold set, the means for grasping releasing the extruded thermoplastic tube and withdrawing from the thermoplastic tube after the finite length of the thermoplastic tube has been grasped by the first mold set or the second mold set.

14. A method of blow molding containers from a thermoplastic material, the method comprising:

substantially continuously extruding a thermoplastic material downwardly ^{along} a vertical axis;

engaging a first finite length of the thermoplastic material in a first mold set at a first position of the first mold set;

moving the first mold set in a closed path having a first leg in which the first mold set is moved from the first position ^{outwardly} ~~upwardly~~ in a first direction and downwardly;

engaging a second finite length of the extruded thermoplastic material in a second mold at the position where the first finite length of the extruded thermoplastic material was engaged by the first mold set after the first mold set has moved along the first leg of its first closed path;

moving the second mold set along a second closed path having a first leg extending outwardly in a second direction from the first position and downwardly, the second direction being opposed to the first direction;

17 removing the blown containers from the first mold set at a
18 second position of the ^{first}~~second~~ closed path, the second position being spaced
19 horizontally away from the first position; and

20 thereafter removing the blown containers from the second
21 mold set at a second position of the second mold set, the second position of the
22 second mold set being the same as the second position of the first mold set;

23 grasping the extruded thermoplastic tube by a device separate
24 from the first mold means and the second mold means and before the first finite
25 length of the thermoplastic tube or the second finite lengths of thermoplastic tube is
26 grasped by the first mold means or the second mold means;

27 moving the device downwardly;

28 grasping the first finite length of the thermoplastic tube or the
29 second finite lengths of the thermoplastic tube while it is engaged by the device;

30 releasing the thermoplastic tube by the device; and

31 withdrawing the device from the thermoplastic tube to permit
32 the first finite length of the thermoplastic tube in the first mold means or the second
33 finite length of thermoplastic tube in the second mold means, as the case may be, to
34 move along the first closed path or the second closed path.